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some greatest revolutions which have in some way directly or indirectly affected the whole earth, and which may therefore be used to form the basis of the primary divisions of time." These he calls "Critical Periods" in the earth's history. The marks of such periods are readjustments of the crust of the earth, causing widespread changes in physical geography, affecting profoundly the climate of the whole earth, and causing marked changes in organic forms. These are indicated in the rocks by (1) widespread unconformities; (2) great, general, and rather sudden changes in organic forms; (3) the introduction of new and higher dominant classes; (4) the birth of great mountain ranges. Of these periods, beginning with the last, he enumerates the following—the Glacial revolution, the post-Cretaceous or Rocky Mountain revolution, the post-Palæozoic or Appalachian revolution and the pre-Cambrian revolution.

Of these it may be said—(1) they become shorter and shorter as we progress in the earth's history; (2) the effect of the introduction of new dominant types in producing changes in the whole organic kingdom steadily increases; (3) the oscillations of temperature have gradually increased. These periods hasten the steps of evolution and increase organic diversity, but diminish geographical diversity. These revolutions seem to be contrary to uniformity in the forces and laws of nature, but they are not so in reality. We may conceive of phenomena as being under the influence of two opposite forces, one progressive, the other conservative. Such will be more or less paroxysmal. Resistance at first prevails, and there is little change, but forces of change are accumulating, and finally resistance gives way and conspicuous changes take place rapidly.

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*Teepee Buttes.* By G. K. GILBERT and F. P. GULLIVER.

In the Bulletin of the Geological Society of America, Gilbert and Gulliver have some interesting things to say of the Teepee Buttes of Colorado. They are found in a belt about ten miles wide and fifty to sixty miles long, at least, beginning at Little Butte Station on the Denver & Rio Grande Railroad, and extending to the south and east along that railroad. They are not continuous but gravel areas separate areas dotted with them. They are twenty to thirty-five feet in height, rudely circular, and diameter is usually less than height. The structure is peculiar, viz., a core of coarse, light-gray limestone, bedded and full of marine fossils, surrounded by a shale which has few fossils

and is rather easily eroded. There is no transition layer between the two, yet they interpenetrate somewhat. Processes of limestone surround portions of the shale, and lumps of limestone are found in the shale, moreover the limestone is roughly separated into beds by shale partings. They find that the steepness of the butte is a function of the rate of degradation of the surrounding surfaces, and that the height depends on the rate of degradation and the size of the cross section.

As to cause, the facts do not seem to be sufficient as yet. They favor the idea that the limestone cores are due to colonies of *Lucina*, more especially which dying on these sites left their shells to form the limestone while fine silts were forming the shales around. Why the molluscs congregated at these places and what caused the apparent mortality we are left to conjecture. They are interesting topographically and unique in some of their relations.

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